The CORNELL ENGINEER

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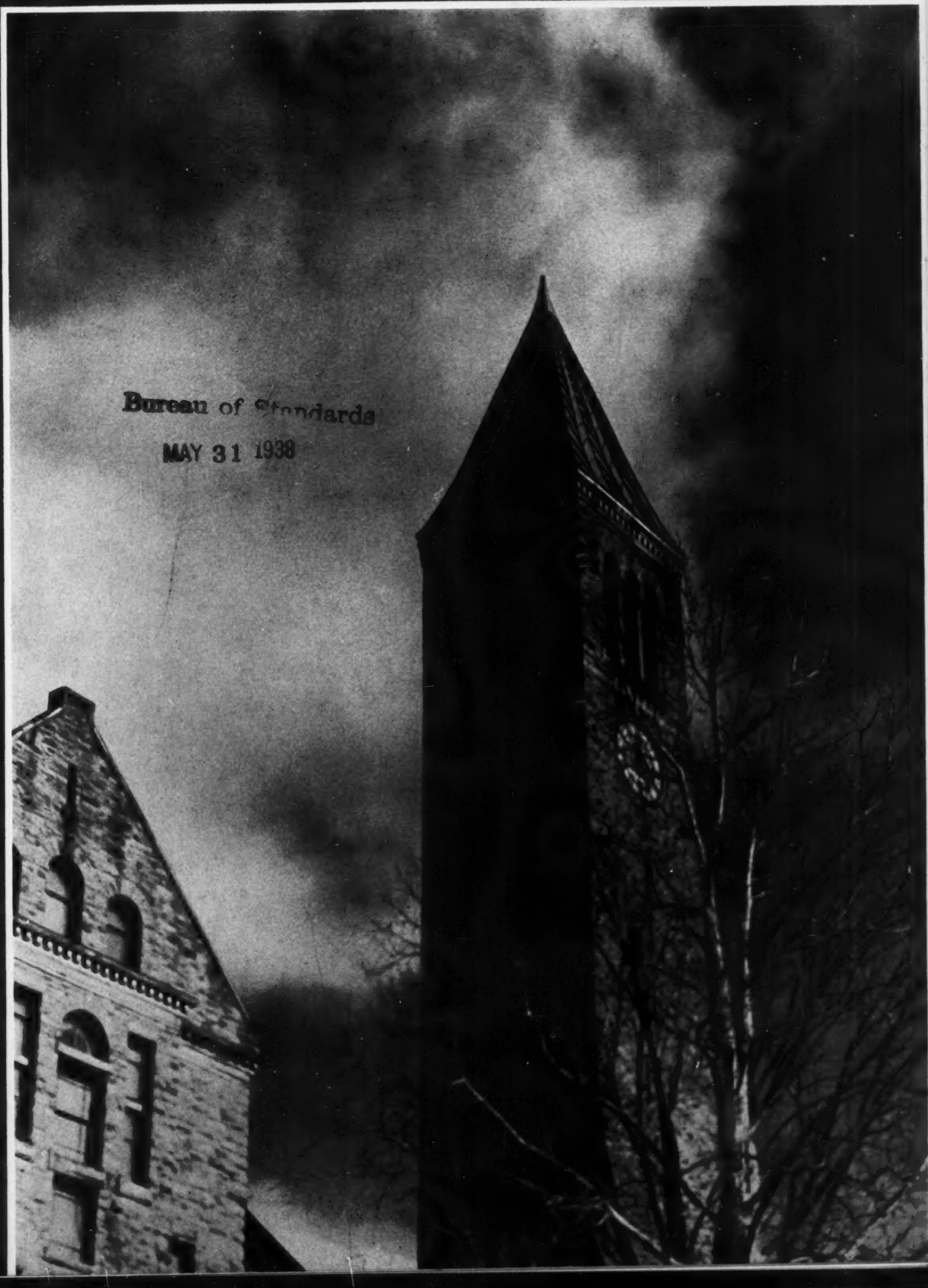

THE CORNELL ENGINEER

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COMMENTS

With this issue of the CORNELL ENGINEER, we complete publication of Volume 3, covering the school year 1937-1938. We will resume publication at the opening of Cornell University in the fall, with plans to make Volume 4 a worthy successor to those that date back to the initial issue of the Sibley Journal of Engineering in 1885.

How glare can be eliminated from photographs by use of Pola Screen is discussed by Mr. Scofield.

Modern Metallurgy and its service to industry is described by Dr. H. W. Gillett.

Robert T. Clark tells of the value of the atmosphere.

John G. Tammen's article on the inspection trip of the Junior Civil Engineers to the Steel City is another feature of this issue.

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Photo by Broganca Herrick *Courtesy U. S. Steel News*

MYRON C. TAYLOR L.L.B. '94

Distinguished Cornellian and University Trustee Who Has Until Recently Headed the U. S. Steel Corporation

Some Of Those Little Things

By H. W. Gillett Ph.D. '06

Chief Technical Advisor
Battelle Memorial Institute

One principle in finding new things is self-evident. To find them, we must be doing something different from what has always been done before. If this something different is done in an extensive and systematic way, we call it research. If we are not hunting for anything in particular other than general knowledge, we call it "pure" or "fundamental" research. If we are looking for a solution to a specific industrial problem, we call it "applied" research. A peculiarity of the latter type is that very often we don't find just what we are after, but we do find something else, a by-product, often of much greater value than what we initially sought.

So that all my comments will not be about metallurgy, let me start with an instance from another field. Owens Illinois has recently developed fibrous glass which is used not only as a heat insulator like mineral wool, but actually as a textile material, especially useful for insulating tape, filter cloth, and bags for bag houses where no other material so well withstands the corrosive conditions. Whether your wife will wear a glass dress or not has yet to be worked out, but anyhow, there is a new material of interesting proven use and of great potentialities. This development came about by a laboratory worker trying to work out methods of putting decorations on milks bottles. Among other ways, he tried blowing powdered glass through a blow torch onto the bottle. The glass didn't stick but drew out into filaments and piled up in a fluffy mass. This by-product, which many workers would have classed merely as an unsuccesful experiment, was followed up, till today there is a new branch of the industry, and Owens Illinois recently dedicated a new research laboratory devoted to work on glass fiber.

The scheme of trying a lot of things and observing closely was used by Edison. When I first got out of college I got a job for the summer in Edison's laboratory. In that laboratory were several outfits that we called the "Old Man's homeopathic analysis". They consisted of bread boards with holes bored into them. Into these holes were set about a hundred homeopathic vials. When Edison wanted to study the chemical behavior of something, he put some of it in each vial and dumped in all the reagents and mixtures thereof he had around, and then he'd sit back and see what happened. A friend of his had rheumatism; so he asked what rheumatism was due to, and was told it was a deposit of uric acid in the joints. He said "Why don't you give the patient something that will dissolve it out of the joints?" The reply was that anything that would do that would kill the patient. His comment "Don't believe it" was the characteristic one whenever he was told a thing couldn't be done. Anyhow, he got some uric acid, put it in the little vials, and dumped in everything he could think of. In this way he found a couple of things that would dissolve uric acid without killing the patient, and the story goes that one of them was taken up by the medical profession as a remedy for rheumatism.

The intentional search for new phenomena can be carried out in the crude way some of Edison's work was done, or with very delicate instruments with which modern research laboratories are equipped; but to make discoveries it is first necessary that we set up new conditions under which the phenomena will manifest themselves.

New conditions are being set up by accident as well as by design, and if a keen observer notes the accident, he may light the spark that sets off a train of highly interesting industrial fireworks. In that train there are many long fuses of drudgery and attention to minute details. Some of our greatest metallurgical advances have come from at least semi-accidental occurrences.

Back in 1909, Wilm, in Germany, was experimenting with aluminum alloys. Among those he tried was one with 4% Cu, ½% Mg, ½%Mn. In testing this he found that a piece that had been cooled fairly rapidly and tested at once was not very strong, but if it happened to lie around a few days before it was tested, it became strong and at the same time retained

CHEMICAL SYMBOLS
used in the article, with their meaning

Ag - Silver	Mn - Manganese
Al - Aluminum	Mo - Molybdenum
Be - Beryllium	Ni - Nickel
Ca - Calcium	Pb - Lead
Cd - Cadmium	Sb - Antimony
Co - Cobalt	Si - Silicon
Cr - Chromium	Sn - Tin
Cu - Copper	Sr - Strontium
Fe - Iron	W - Tungsten
Mg - Magnesium	

good ductility. This was a curious and baffling state of affairs, and all Wilm could do was to establish that it was true and that he could repeat his results. He had a better aluminum alloy than had hitherto been made, but he had no inkling of the mechanism involved.

Ten years later, at the Bureau of Standards, Merica studied the phenomenon from the scientific point of view and concluded that the alloy was precipitating, in the solid, tiny particles, invisible under the microscope, of a definite chemical compound, magnesium silicide. It later turned out that a second compound, a copper aluminide, is also concerned, and that, of the wide range of improvable aluminum alloys that have since been developed, only those with both compounds become notably stronger on aging at room temperature. Higher temperatures are generally required.

If you have been listening carefully, you will recall that I said that Wilm added Cu, Mg, and Mn to Al. I didn't say anything about Si, but naturally we have to have Si to form magnesium silicide. That's where the accident comes in. Commercial aluminum had, and still has, because it is difficult to remove it in purification of the ore, a few tenths of a per cent of Si as an "impurity". Without the accidental presence of this impurity, the noting of the phenomenon and its explanation would have been long delayed.

The direct result of this observation is the availability of strong alumium alloys for aircraft, lightweight passenger cars, and a myriad of other uses. The direct result of the explanation of the phenomenon by Merica was even more far-reaching, for it pointed out that other alloy systems might be amenable to similar improvement and started a metallurgical hunt for these other cases.

In somewhat similar fashion, Kinnear, then at the Marion Steam Shovel Company, now with Battelle, made copper steels of higher than normal Cu content and put them through a variety of paces in heat-treatment, including treatments quite unusual for steel. A similar precipitation hardening was observed and at once recognized, because of Merica's clarification of theory, as another case of precipitation hardening, even though the precipitated material was soft copper and not a hard chemical compound. Note that Kinnear, too, was doing something out of the usual run.

Now that the precipitation hardening mechanism is understood, we have improvable alloys not only of Al and Cu plus Fe, but there are copper alloys hardened with Si, and Be, Monel metal hardened with Si, and W-Fe-Co and Mo-Fe-Co alloys are being developed for cutting tools intermediate in properties between Stellite and Carboloy. Epstein, at Battelle, found that even electrotype metal can similarly be precipitation hardened. The alloy 2Sb-1 Sn-197 Pb, quenched from 400°, held at room temperature one hour and put in boiling water five minutes, doubles in hardness.

Lead is remarkable in the small amount of alloying elements that will strengthen it by precipitation hardening. The ordinary battery grid contains some 9% Sb. Grids of equal strength can be made, by adding 0.1% Ca or Sr and precipitation hardening, which have advantages in electrical conductivity and in other ways.

A development in the zinc-base die-casting game illustrates the great effect of small percentages of impurities. You recall how the die-cast radiator ornaments on your car of 5 or 10 years ago cracked up in service. They were made of quite pure zinc, but they had just enough impurity to make them unstable. Then electrolytic zinc was developed, not so much in the desire to get better zinc, but rather to handle certain types of ores in more economical fashion. Applying this 99.99+ purity metal to die castings, it was found that the impurities had been the culprits. Upon the electrolytic and upon distilled zinc of equal purity rests the present zinc die-casting industry. Elimination of something like 0.05% impurity made all the difference.

The eye appeal of the present automobile is largely built around zinc-base die castings and carburetors, and fuel pumps are almost universally made of them because they are so cheap in material and in production cost. The Cr plating which covers the grills is only about 2 one hundred thousandths of an inch thick and might deserve to be classed among the "little things." All electroplating is thin, but the thinness of Cr plating is only exceeded by that of the gold plating on safety razors, for example. A cent's worth of gold would plate quite a few.

Plating is sensitive to little things. A few years ago, much use was made of Cd plating, which gave a bright, rust-resistant coating. Then we began to put more HP into autos, and until the cooling systems were modified babbitt bearings were not quite adequate to stand the higher temperature. Better bearings were sought, and people began to look into Cd as a bearing metal. Harder, at Battelle, working with Federal-Mogul, developed a Cd-Ag bearing, later modified by Federal-Mogul and by Pontiac into Cd-Cu-Ag, and

Schwartz developed Cd-Ni. These bearings went over so well that the price of Cd went way up, and it became too expensive for much of the Cd plating. So the platers got busy and put addition agents into the zinc plating bath. These traces of a Mo salt or of certain organic materials make the Zn coating come down bright, so that the bright zinc coatings look even better than the Cd coats used to. As Zn is as good as or better protection than Cd, we are no longer confined to Cd. As to the bearings, most cars have modified the cooling systems and gone back to babbitt, but Ford still uses the Cd bearings in the floating bushing. His use (only 10% shy of a million pounds in 1937) is sufficient to keep the price of Cd up.

The metallurgist used to think that a bearing metal had to have a duplex structure, hard particles in a soft matrix. Such an idea is useful in steering experimentation along the right road if it is a correct idea, but if it happens to be wrong and nobody has courage enough to try the things that any expert knows won't work, it may be far from useful. It was found that a very thin coating of pure tin or cadmium electrodeposited on a piston allowed it to be fitted very closely and to wear in without damage. This behavior raised a question as to the validity of the idea that a duplex structure is needed in a bearing and set people to trying other things. The most severe bearing duty we have is in aircraft engine main bearings when the plane is put through a power dive. The bearings that are behaving best in that service today are of pure silver. It pays to try things that everybody knows won't work.

STAINLESS STEEL — AN ACCIDENT

Among the developments due to accidental observations is our present-day stainless steel. In 1912 Brearley was trying to get an erosion-resistant steel for rifle barrels. Among those he tried was one of 13% Cr. He noted that this was hard to etch for metallographic examination and hence studied the corrosion resistance. From this came the cutlery grade of stainless. Meanwhile, in Germany, Strauss was looking for a pyrometer protecting tube, and in his series of alloys he included 20% Cr, 7% Ni. He too noted the corrosion resistance and from this developed the well-known 18:8. Both experimenters were after something quite different, and the by-products were worth far more than the thing they aimed at.

Becket, in the United States, made steels of proper composition for stainlessness before the foreign workers did. But it happened that after he got through testing the steels for mechanical properties he stored them in stoppered bottles, so that none of them rusted, and thus he missed noting the corrosion resistance.

Even the effect of Si in such steels, now developed into the Silcrome valve steels, was accidentally noted. Armstrong accidentally got some asbestos into a melt; silicon was reduced, and the behavior of Si-Cr steels was then intensively studied.

Another example of watching details cropped up at Battelle a while ago. In some work on soldering, much better joints were obtained in one series than in the repeat tests. The chap doing the work tried to see what the difference had been in his practice and figured out that in the good series he had applied the acid flux with a bristle brush, and in the poor it had been dropped on. This led to determining that the amino products from the reaction of the acid with the bristles were of the type that are known as "wetting agents" and that the use of wetting agents is helpful in fluxing for soldering.

A VALUABLE TRIFLE

A little thing that has had vast economic importance is the tiny tungsten filament in our electric lamp, which has saved billions of dollars worth of electric energy over what would have been required with the old carbon filament. The tungsten filament was no accidental discovery; it was intentionally sought by the General Electric Company with every facility at its command. It had been found that tungsten, with its high melting point, could be run at a very high temperature and consequent efficiency, but the early tungsten filaments were brittle. I remember that we got some of these lamps when I was a student at Cornell early in the 1900's. They came packed like eggs, and even then half of them came broken. The least jar would break them, and anything like the present automobile lamps was a long way off. Coolidge of the General Electric Company set out to produce ductile W, but every attempt to make it ductile by the methods known to be suitable for other metals failed. Coolidge had to try methods that the metallurgist of that day would have said had no hope whatever. Instead of melting, casting, rolling, and annealing before cold drawing, the metal powder had to be compressed and sintered to a sponge, then worked down by hot swaging at 1550°C., and then hot drawn. After some hot drawing has been done, the metal decides to be tractable and from then on is ductile in the cold and can be drawn down to very tiny sizes. The product is our strongest material —it has a tensile strength of 600,000 lb. per sq. in. But

(*Continued on page* 228)

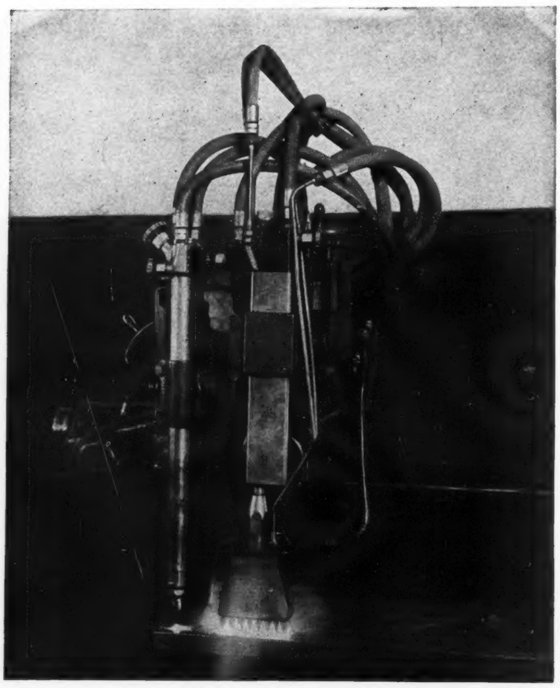
Battelle Memorial Institute, Columbus, Ohio, established for the promotion of research

Industrial Uses Of The Atmosphere

By Robert T. Clark, Chem. E. '41

SINCE we live at the bottom of a sea of air, our lives depend upon the composition of that air. While this condition has existed since prehistoric ages, it is only in comparatively recent years that the composition of atmospheric air has been accurately determined and that any of its manifold industrial uses have been discovered. But as a result of the work of the physicist and chemist, the nine constituent gases of air are now known; and as a result of the work of the engineer, these gases, "as free as air", are being used to reduce the cost of living.

During the early history of mankind, air was considered one of the four elements of which the world was composed, the other three being earth, water, and fire. Not until 1774, centuries later, did Priestley discover the atmosphere's most important component by heating red oxide of mercury. Lavoisier, "founder of modern chemistry", gave the name "oxygen" to Priestley's discovery, a Greek word meaning "acid-producing." After removing the oxygen from the air, there still remained another gas; this residual portion of the atmosphere Lavoisier called "azote," because it could not sustain life. The name is still retained in French for what we call nitrogen.



The flame softening process widens the use of low alloy steel for structural purposes.

By 1787, then, air was no longer regarded as an unfathomable mystery with varying characteristics due to ghostly properties. The word *air* became limited to atmospheric air, thought to be composed of oxygen and nitrogen, with small quantities of water vapor, dust, and carbon dioxide.

A century passed, and it was still believed that all the constituents of the atmosphere had been disclosed. But in August, 1894, Sir William Ramsay and Lord Rayleigh, two renowned English scientists, announced to an incredulous world that they had found a new gas in the atmosphere, amounting to almost one per cent of the air. The discovery came about through pondering the simple fact that nitrogen, when prepared from air, was distinctly heavier than a similar volume of the gas made from ammonia or any other chemical. By utilizing red-hot magnesium to absorb the atmospheric nitrogen, the investigators found remaining a small residue in which was present a small quantity of the hitherto unknown gas. They called this new gas "argon," meaning idle, since it did not enter into chemical union with other elements.

While searching for new sources of argon, Ramsay heated the mineral cleveite and obtained a gas which gave a spectrum identical with that of helium, detected in the sun back in 1868. Although helium was first obtained in this way, it was later found to be present in the atmosphere to the extent of one part in 250,000. Argon and helium were found to be so inactive chemically that they were termed the "inert gases." A study of their position in the periodic table led to the belief that at least three more inert gases should exist; and Ramsay, with M. Travers, singled them out, in 1898, from the liquid air residues remaining after the nitrogen and oxygen had been removed. Present in the air to only an extremely minute extent, they were christened neon, krypton, and xenon.

Thus by the beginning of the twentieth century, the composition of atmospheric air had become fully known, at least near the earth's surface where humanity struggles on. While its humidity varies constantly, the proportions of the dry gases present are remarkably constant; and by international agreement these proportions are given as:

Oil pipe line constructed by multi-flame Lindewelding

Nitrogen	78.03% by volume
Oxygen	20.99% by volume
Argon	0.94% by volume
Carbon dioxide	0.03 % by volume
Hydrogen	0.01% by volume
Neon	I part in 65,000
Helium	1 part in 200,000
Krpton	1 part in 1,000,000
Xenon	1 part in 11,000,000

The production of liquid air in quantity forty years ago created considerable popular interest. But while the substance was found highly suitable for use in research work at sub-zero temperatures and in purifying certain materials, there developed only one major industrial use for liquid air—to manufacture an explosive for blasting rock. The explosive mixture is produced by pouring liquid air over a porous form of carbon, such as charcoal or coke. Since it gives rise to no harmful gases upon detonating, the explosive is especially suitable for use in iron mines and in tunneling projects.

Now by applying a process called rectification to liquid air, the separation of nitrogen and oxygen can be effected almost completely, the oxygen purity being as high as 99.5 per cent and the nitrogen over 99.5 per cent. When either oxygen or nitrogen of high purity is desired, the other product is usually discharged with a purity too low for commercial use. Air-separation plants, therefore, are seldom used to manufacture both oxygen and nitrogen. The few plants producing nitrogen furnish the pure nitrogen necessary for filling incandescent-lamp bulbs and for making cyanamid and ammonia for fertilizer. Most of the plants, however, are employed in the production of 99.5 per cent oxygen for use in the fusion welding or cutting of metals.

The use of oxygen in metallurgical and other similar industrial processes has been a subject of recurring interest to the engineer. By increasing the oxygen content of the air used in blast furnaces, metallurgical engineers feel that not only the blast, but also the fuel, ore, and flux, are made more efficient and productive. Moreover, they feel that nearly pure oxygen should be employed more extensively in such industrial operations as the production of steel in Bessemer converters and open-hearth furnaces, or the treatment of non-ferrous metals and ores. As soon as oxygen can be reliably produced and transported in large quantities at low cost, huge oxygen plants will undoubtedly be erected to supply all possible markets.

Whereas nitrogen and oxygen are easily obtainable, the inert gases constitute such a minute part of the atmosphere that it was once impossible to produce them cheaply enough to warrant their commercial use. 20 years ago, though, improved methods in the fractional distillation of liquid air resulted in the development of new uses for these gases. Argon and nitrogen at low pressure are the usual fillers for electric lamp bulbs. The intense orange-red color which neon emits on being subjected to an electric discharge accounts for its present popularity in advertising signs and for airport beacons. In July of 1937, krypton-filled lamps were introduced to the American public; and because of the remarkable cooling effect of the krypton, the average

(*Continued on page* 214)

Here is use for an explosive of harmless gases

Photography By Polarized Light

Being An Explanation Of The Pola Screen And Its Use

PAUL R. SCOFIELD, A.E.-M.E. '37

The fact that light rays can be caused to vibrate in one plane has been known to the scientific world since 1169 when Erasmus Bartholinus observed the double refraction of Iceland Spar, but the application of the phenomenon to photography is comparatively recent. Up until 1930 prisms made from Iceland Spar, or Nicol Prisms, were known to be satisfactory polarizers of light, but these prisms were so expensive and had such a small field that their application to photography was limited to experimental work.

In 1930, Mr. Edwin D. Land, a Harvard Senior, was playing around with a piece of rubber upon which he had placed a pencil. As he stretched the sheet he noticed that the pencil moved until it was parallel to the length of the sheet. This set him to thinking about the manufacture of a polarizing material and it dawned upon him that if he found a polarizing crystal and imbedded it in a rubber-like matrix, he could produce a cheap and yet satisfactory polarizing material. He set out to find such materials and after considerable research found that cellulose acetate was a good matrix and the minute crystals of Herapethite were satisfactory as a polarizing medium. In making the polarizing glass that he called Polaroid, he imbedded the crystals in the liquid cellulose with a thousand billion to the square inch. Then the matrix was stretched when slightly cooled and the crystals lined up so that their axes were parallel. After this, he placed the sheet between two layers of glass in a manner similar to the way shatter-proof glass is constructed and obtained what is called Polaroid, a material that has more uses than a hairpin.

Eastman Kodak Co. recognized that this material would be very valuable in photography and started the manufacture of the Eastman Pola Screens, Types I and II. Type I uses Polaroid mounted in a light weight metal cell with a convenient handle for use in front of the lens;; Type II, which is placed over the light used to illuminate the subject, is made up of a single sheet of polarizing material cemented to a single sheet of glass. However, in using the phenomenon in photography, it must be remembered that there is no advantage in polarizing the light that enters the camera lens unless the light is already polarized. In nature, there are two sources of this polarized light:

1. Ordinary, unpolarized light specularly reflected from a non-metallic surface at an angle of 32°-37° to the surface.

2. Light from a clear blue sky arriving at right angles to the sun's rays and the reflection of such rays from water.

Thus from these two sources, much of the light from objects photographed is polarized and a photographer can vary the amount of light he admits from an object by the rotation of a Pola Screen placed on front of the lens.

A further improvement in picture taking results when a Pola Screen is used over both the lens and the light source. This arises from the fact that when a ray of light hits an object it is specularly and diffusely reflected; but if the object is illuminated by light that passes through a Pola Screen, the light is plane polarized and those reflected rays that are specular will still be plane polarized. Thus if the subject is viewed through a Pola Screen on the lens, the screen can be turned so the subject is visible by specularly or diffusely reflected light. If detail is desired, the object should be viewed by diffusely reflected light instead of specularly reflected light as the latter type obscures detail. On the other hand, if a more glossy object is desired, the screen should be turned to admit only the specularly reflected rays; or if some detail and some gloss is wanted, the screen should be turned to admit some of each type of reflection.

The Type I screen, used over the lens, is useful in a great many ways at present and as time passes it will undoubtedly become even more useful. At present the Type I screen is used for the following purposes

1. Photographing through glass or water.

This is accomplished by placing the camera axis at from 32°-37° to the surface and turning the screen so its plane of vibration is nearly at right angles to the specularly reflected rays. In this way reflections are removed and detail is shown.

2. Subduing oblique reflections and showing surface texture.

As before, this is accomplished by placing the camera axis at 32°-37° to the surface and cutting out the reflections from parallel surfaces by turning the screen. By doing this, the texture and pattern of the material are plainly visible.

3. Photographing buildings.

By placing a screen over the lens, much control is obtained over the brightness of the roof and wall relative to each other and to the sky.

4. The production of dark sky effects.

This is possible because blue skylight arriving at right angles to the sun's rays is polarized and can be cut out by the proper setting of the screen. The greatest effect is produced when photographing the sky in such a way that the axis of the camera is at right angles to the sun's rays. Thus, in the morning the region of greatest effect is north, overhead, and south; at noon, near the horizon in all directions, and at sunset, north, overhead, and south. No effect is obtained with the camera pointed at the sun or away from it.

By using the camera in this manner, buildings, trees, and people can be made to stand out against a dark sky and by using a red filter with the screen, night effects can be obtained in daylight. The sky is darkened but the Pola Screen does not affect the colors of the foreground objects. Because of this it is the only known method of obtaining a dark sky effect in color photography.

5. As a variable density filter.

This is accomplished by using two Pola Screens for the lens in the two slots in the holder. With handles of the two screens together, the effect is that of a light gray neutral density filter with 32% of the light being admitted. With the handles at right angles the effect is that of a very dark neutral gray filter which transmits 16% of the light.

6. Recording photographically the stresses and strains in shapes under mechanical tension.

This is accomplished by photographing the structure through a Pola Screen and observing the character of the edges of the object. The birefringenc of some crystals and fibers, causing certain transparent objects to light up in vivid colors when placed between crossed polarizing screens, can be noticed with silk, cotton, wool, and many natural crystals.

Besides these applications, many additional uses are available when the Pola Screen is used over both the lens and the light scource. Among those already known are:

1. Copying and reproduction work.

Until the discovery of Polaroid, Matte and rough surfaces presented grave difficulties in copying. This is due to the fact that the black of a matte or rough surface reflects about one-fiftieth of the light while the black of a glossy surface reflects one-hundredreth of the light, and, as the result, the glossy surface has the deepest blacks and the greatest brightness range.

However, by polarizing the illumination and removing the specular rays by a lens screen, the blacks of all surfaces reflect about one-hundredth and the brightness range of the matte surfaces equals that of the glossy surfaces. The lights for illumination can now be placed close to the camera axis or close to the spot that gives the most uniform illumination, and the reflection can be disregarded.

It is now very simple to copy a framed picture as the frame does not have to be removed to remove the reflections from the glass, and reproduction of crayon and India ink drawings is simplified owing to removal of reflections from carbon particles which formerly caused poor blacks. Also by use of the screen, the reproduction of oil paintings is simplified because there are no longer any troublesome reflections from the varnish and the pigments.

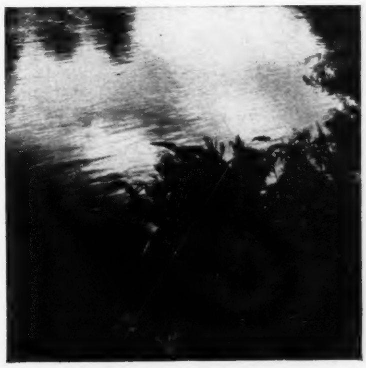
II. Photographing furniture and plastics.

In the past it has been difficult to photograph the grains of polished surfaces and the pattern in plastic especially if the surfaces were curved. However, by using the screen set at an intermediate position, the grain may be brought forth; yet the presence of some gloss will prevent the picture from looking dead.

III. Photographing silverware and other polished surfaces.

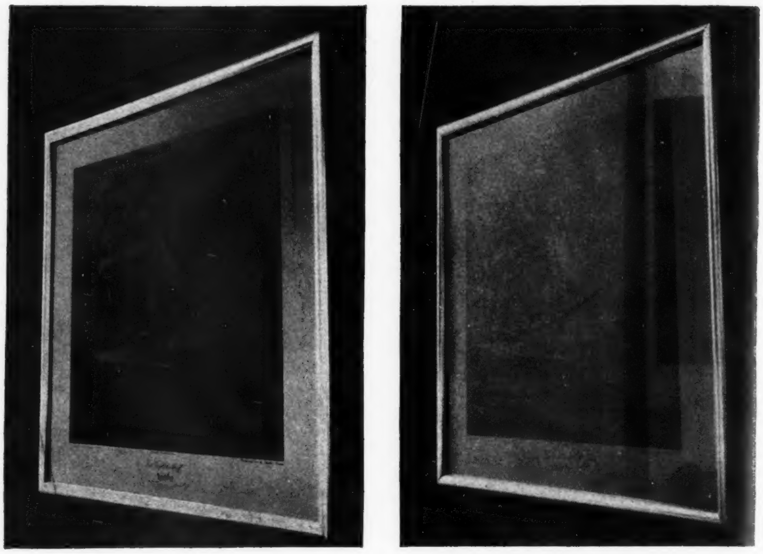
In photographing polished silverware, the reflections normally are brilliant; thus halation results and scratches show up conspicuously. However, by using polarized light, these difficulties are removed and brilliant spot lighting may be used.

With Herotar



All illustrations courtesy Carl Zeiss, Inc.

With Light Yellow Filter



With Herotar — Without Herotar

Herotar is the trade name for a Pola Filter

IV. Photgraphing objects of art.

It may be desired to remove reflections from brush markings or canvas texture or enhance them, and a Pola Screen in the proper position will accomplish the desired result.

V. For producing various effects on faces.

By placing the screen in the crossed position the facial colors are heightened, and by placing them in the parallel position, a perspiry appearance results.

VI. In making drawings in motion picture work.

In making these drawings several layers are built up and as the number of layers increases, the reflections increase, so that the number of layers that could be used was formerly limited. However, with the use of the crossed arrangement of the Pola Screens, these reflections are reduced and the number of layers may be increased.

In using both a lens and a light screen, the lights should first be placed to the best advantage, ignoring reflections. Then the Pola Screens should be put over all the lights so all the light passes through the screens and so that the index marks indicate a horizontal vibrating plane. The lens Pola Screen is then placed with the handle vertical so that the vibrating plane is vertical. Now all the lights except one should be turned out and the Pola Screen over this one light turned until the reflections are at minimum. Then this light is turned off, and each of the other lights is adjusted likewise; the camera screen now is said to be crossed with respect to the light screen. However, if any reflections are desired, this is accomplished by rotating the lens screen.

After this discussion of all the things that a Pola Screen will do, one might think that there is practically nothing that it will not do. However, there are several things that cannot be accohplished. For example:

1. Metallic reflections cannot be entirely eliminated.

2. The use of a screen over the lens alone is not effective in copying and reproduction.

3. The Pola Screen will not control halations unless the bright region that causes the halation is a reflection.

4. Reflections from a horizontal and vertical surface cannot be removed at the same time.

5. Reflections from store windows cannot be removed when photographing with the samera at right angles to the glass.

When using a Pola Screen to produce the various effects, any photographic negative material will produce results, but the most satisfactory work is accomplished with Type B Panchromatic film or Wratten Panchromatic Plates. In regard to exposures, one should increase the exposure about 4 times when one screen is used and 16 times when two screens are used with Panchromatic film. If one desires to use a photographic cell type of exposure meter, the proper reading can be obtained by holding the Type I Screen over the meter window with the screen and the meter at the intended angular position. However, in attempting to accomplish any of the possible effects, one must always bear in mind that perfection is obtainable only after considerable practice and experimentation, and whether a picture is good or bad hinges upon the care taken in planning and studying out the individual

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USES OF THE ATMOSPHERE

(*Continued from page* 211)

light of each lamp was greatly increased.

Electrical engineers have also expanded the color range of the gaseous lights. In addition to the natural colors of the lights themselves, such as the purple from argon and the orange-red from neon, colored glass is being used to obtain varieties of shades; and the two, colored glass and light, are being combined much the same as the artist mixes primary colors. A brilliant golden-yellow, for instance, has been obtained by placing a helium arc in amber-colored glass. As can be readily understood, the industrial application of these inert gases is based primarily on their characteristic inertness and on their ability to glow when subjected to an electric discharge.

While we are still at the mercy of wind and rain and of flood and drought, no longer are we awed by the once-impenetrable mystery of atmospheric air. The men of science, brilliantly applying their talents, have disclosed its true nature. The engineer, utilizing the researches of these men, has succeeded in putting to work of gases of the atmosphere for mankind's benefit.

Pittsburgh Inspection Trip

John G. Tamme, C.E. '39

This year's annual inspection trip of the Junior class of Civil Engineers consisted of a tour of the Pittsburgh Industrial District. The group left Ithaca, Sunday morning, in two busses which furnished the transportation throughout the trip.

The Homestead plant of the Carnegie-Illinois Steel Corporation was inspected Monday. First we visited Carrie Furnaces where the blast furnaces and stoves are located. Our visit was arranged to coincide with the tapping of one of the blast furnaces, one of the most spectacular scenes in industry. In the open hearth division, we saw the tapping of an open hearth, and the pouring of the white hot metal into the ingot molds; then the stripping of the molds from the ingots was watched. The 100 inch semi-continuous strip mill and a reversing mill used in rolling steel plate were seen before we ate lunch in the plant cafeteria.

After lunch we inspected the structural sections mill. This completed, we went back to Pittsburgh to a dinner given for the group by Carnegie-Illinois. Following the dinner was a discussion of recent developments in the steel industry.

Tuesday morning we went to Ambridge, Pa. to visit the plant of the American Bridge Company. At this fabrication plant we saw the operation of erecting structural members from some of the sections we had seen rolled at the Homestead plant. The multiple punch which can punch as many as thirty-two holes at once and the machines used in the manufacture of rivets were inspected. We saw the erection of some of the members to be used in the Perisphere at the New York World's Fair, and the tower sections of the Bronx-Whitestone.

On the reurnt trip to Pittsburgh we stopped at Emsworth to see the Emsworth Vertical Lift Dam. We saw the gates and the navigation locks operate and drove on to the Allegheny Steel Company plant at Brackenridge, Pa.

The Allegheny Steel Company manufactures alloy steels, using electric furnaces and open hearths in refining the metal. The 30 inch continuous strip mill, the 12 inch bar mill, the lamination stamping department, the sheet mills with automatic operation of feeding and catching, and the seamless tube mill were also in operation. Following the inspection of the plant we were guests of the Allegheny Steel Company for dinner. After dinner we discussed stainless steel and other alloys, and the problems of the steel industry with labor unions.

Wednesday, we first inspected the plants of the South Pittsburgh Water Company, including the pumping station near Beck's Run on the Monongahela River, and the treatment plants high above the river. We learned that because of wide variation in the hardness and the amount of free uncombined acid in the water, it is necessary to keep a careful pH control of the water at this plant.

In the afternoon we inspected the plant of the Universal Atlas Cement Company, following the manufacturing process from the driers and ball mills through to the sacking machines and testing laboratories. Slag from the steel plants is used as a raw material, and electricity for power is generated at the blast furnaces.

On the trip from Pittsburgh back to Ithaca, Thursday, we stopped to inspect the Crooked Creek Flood Control Project. The U. S. Engineers are building the dam across this tributary to the Allegheny for flood control and water storage. This completed our inspection tour and we drove on to Ithaca, realizing how enlightening inspection trips can be at a time when the textbook seems inadequate.

Editor's Note: *These eight pages of photographs show the processes in the manufacture of stainless steel in subsidiaries of the United States Steel Corporation and were supplied to us through the courtesy of its employee magazine, U. S. STEEL NEWS*

Illustrations and captions by courtesy of US Steel News

THIS HOT METAL IS STAINLESS STEEL

Fig. 1. Tapping a heat of USS 18-8 stainless steel from a 30-ton Heroult electric furnace at South Works, Carnegie-Illinois Steel Corpn., Chicago. Note the observer checking the pouring temperature of the metal with an optical pyrometer.

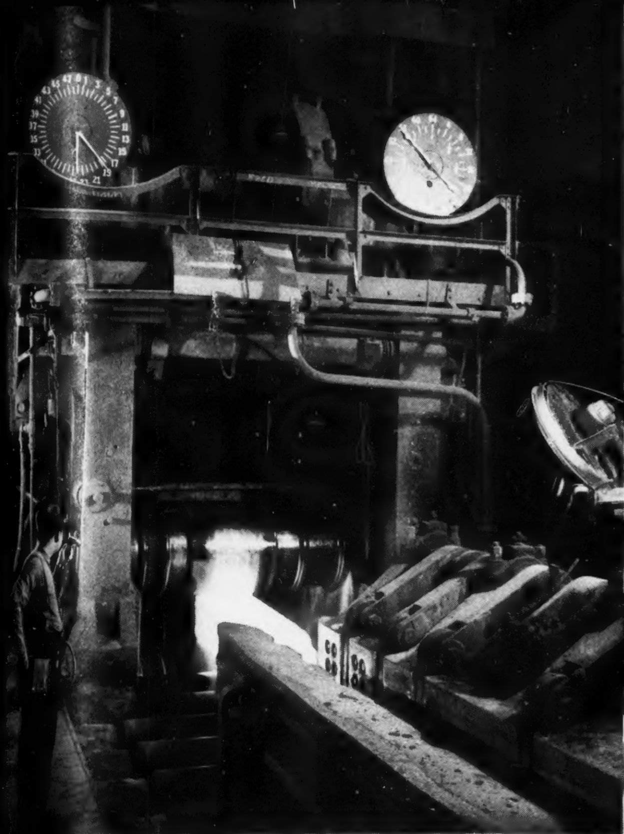

Fig. 2. (At left). Blooming mill at South Works, Carnegie-Illinois Steel Corpn. Here stainless steel ingots are rolled into blooms, billets or slabs for further processing. Notice another "brain truster" checking temperature with an optical pyrometer.

Fig. 3. (Below). Cooling bed of 96-in. continuous plate mill, South Works, Carnegie-Illinois, where stainless steel plates are rolled.

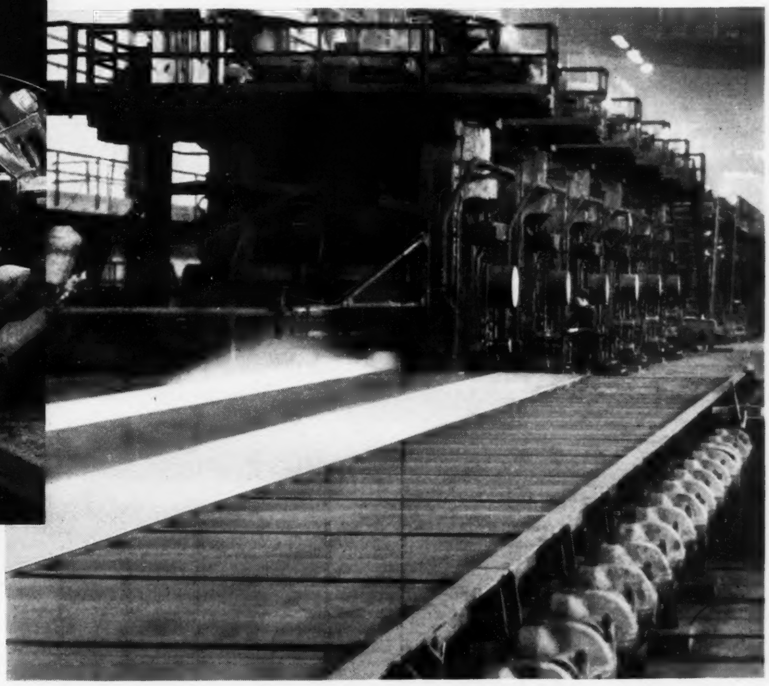

Fig. 4. (At left). Coils of hot-rolled stainless strip which will be further processed into cold-rolled strip or will be cut into breakdowns for rolling into sheets. The employee is putting a micrometer on the edges to see whether they are of the right thickness. This is called "inspecting for accuracy of gage." Gary Works, Carnegie-Illinois Steel Corpn., Gary, Ind.

Fig. 5. (At right). Rolling stainless steel sheets at Wood Works, Carnegie-Illinois Steel Corpn., McKeesport, Pa. The man at the right is blowing compressed air on the sheet to remove any loose scale which may be present. It is important to keep the sheet free from such scale during rolling to prevent marking.

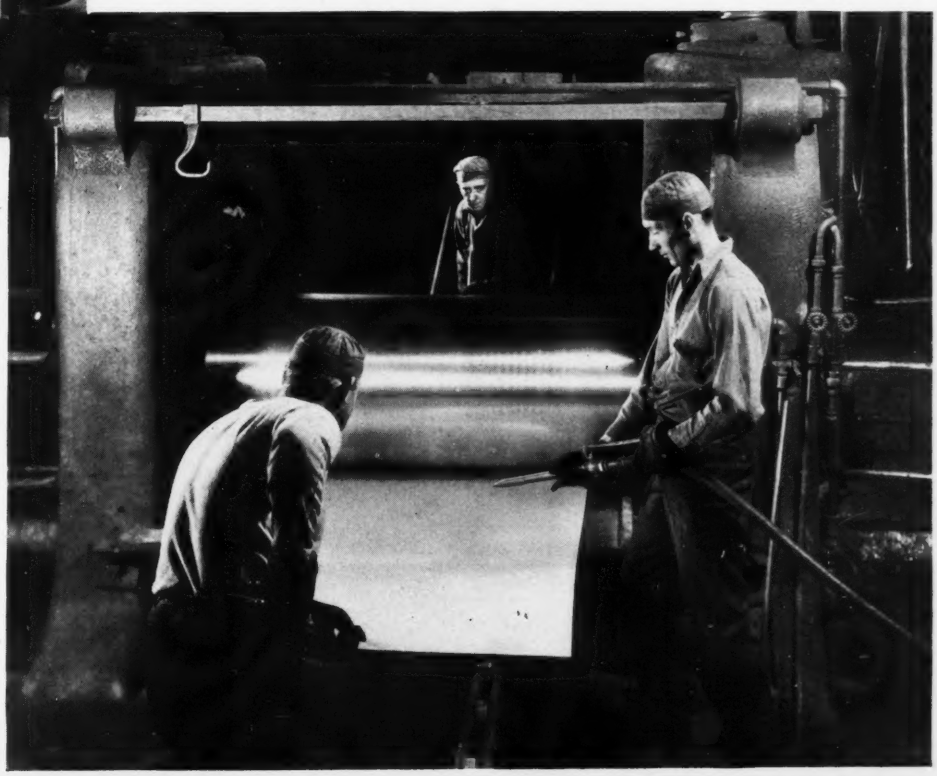

Fig. 7. (Below). Continuous annealing furnace, Wood Works, Carnegie-Illinois, in which stainless steel sheets are heat treated. The stainless sheet is laid on a "rider" or "waster" sheet for its ride through the furnace. The conveying mechanism is below the furnace except for the dogs (supports projecting from a continuous chain belt) which hold the sheets. The dogs project through slots in the furnace bottom. Note the two ventilating fans which help to keep the operator comfortable.

Fig. 6. (Above). Rolling stainless steel sheet at Wood Works, Carnegie-Illinois.

Fig. 8. (Below). These stainless steel sheets have just been pickled and are about to be immersed in a water tank to be washed and rinsed. Wood Works, Carnegie-Illinois Steel Corpn.

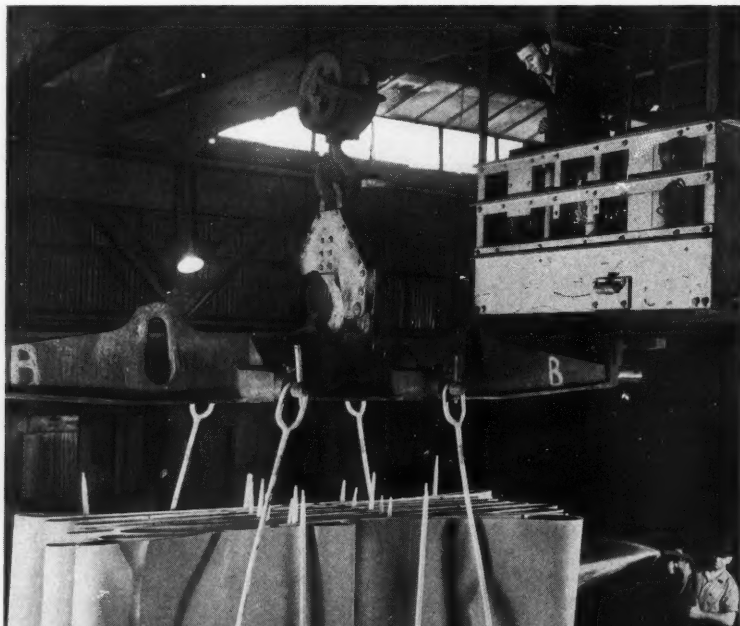

Fig. 9. (Below). Four-high mill where stainless steel is cold-rolled to produce a smooth surface finish or high tensile properties. Wood Works, Carnegie-Illinois Steel Corpn.

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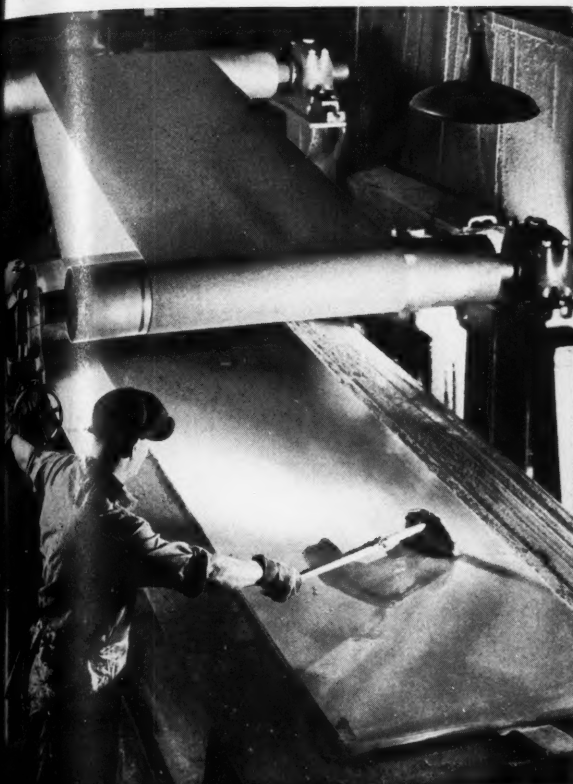

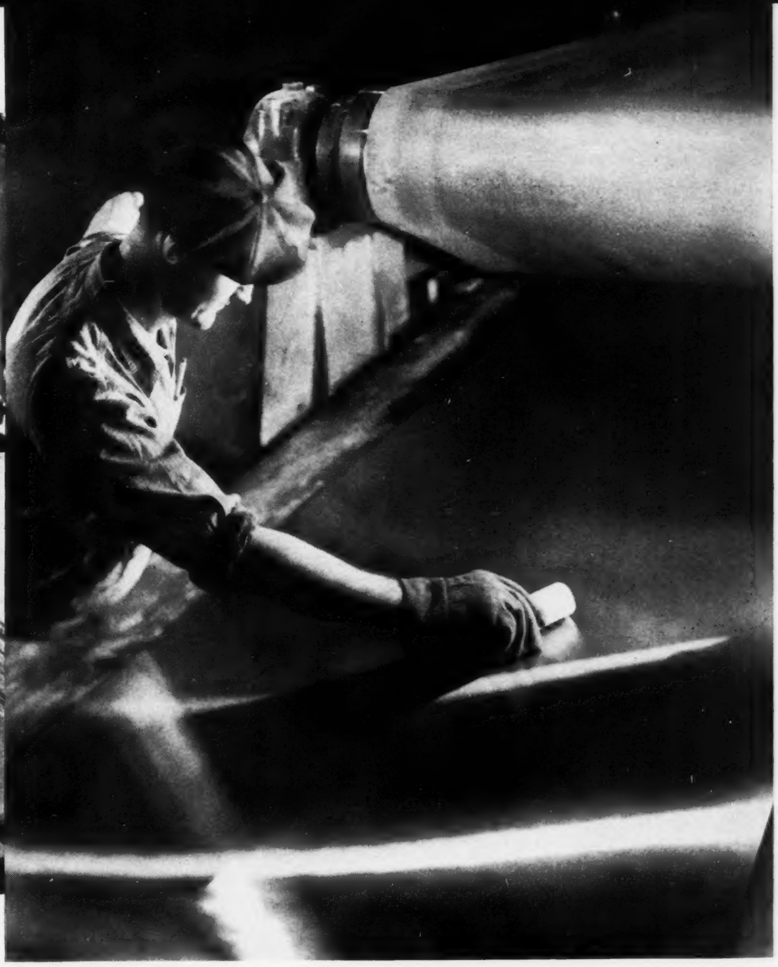

Fig. 10. (Upper left). Rough-grinding stainless steel, Wood Works. The operator is slushing grease on the sheet.

Fig. 11. (Above). Finish-grinding stainless steel sheets, Wood Works. The operator is applying a suitable grease.

Fig. 12. (Left). Hydraulic stretcher leveling machine, Wood Works. In this machine the stainless steel sheet is stretched just enough to produce a smooth and even surface.

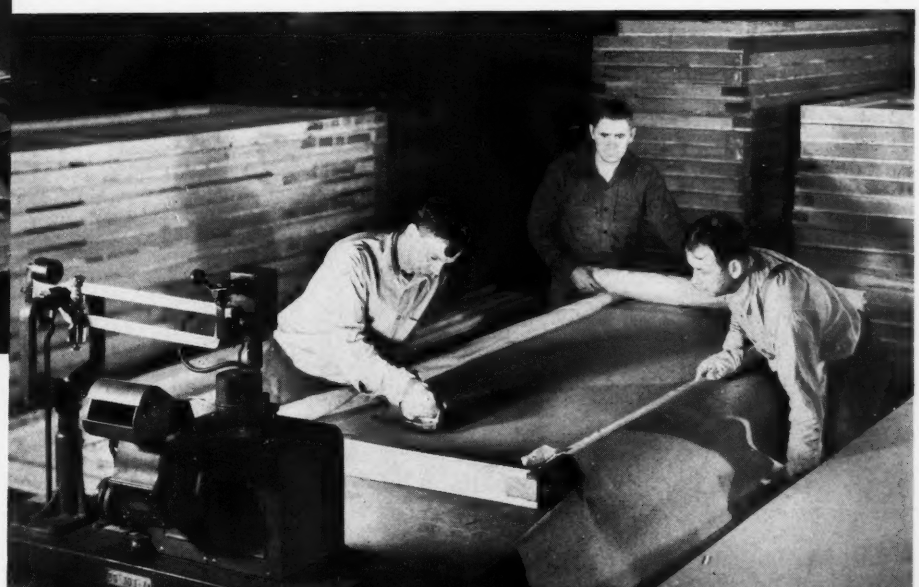

Fig. 13. (Right). Packing and crating stainless steel sheets, Wood Works. The polished sheets are interleaved with specially selected paper to prevent marring and scratching. The employee at the left is marking the sheet with a rubber stamp. Packing, inspecting and weighing are simultaneous operations here. The empty box and the paper are weighed first and the scale is set to tare. Hence when the box is packed the scale shows the net weight of the contents.

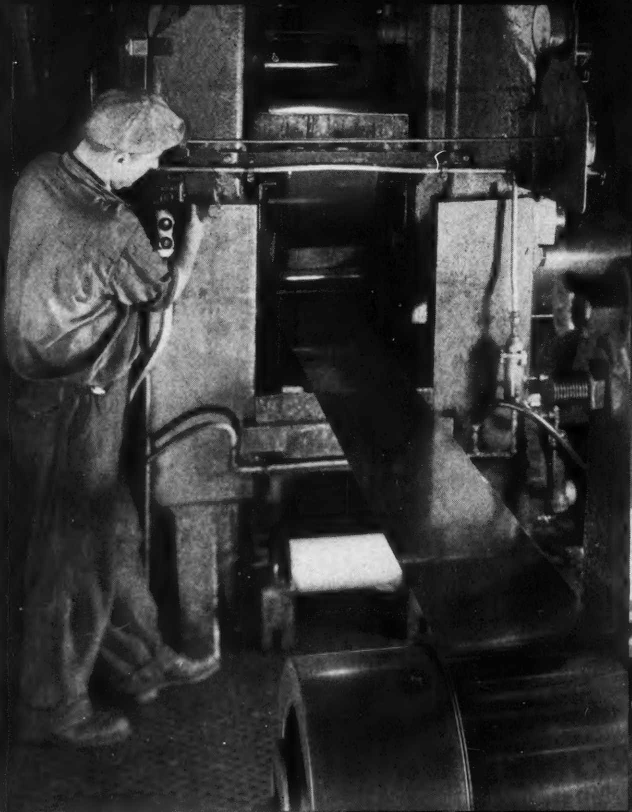

Fig. 14. (Upper left). Cold-rolled stainless strip leaving a 12-in. four-high cold-rolling mill at Cuyahoga Works, American Steel & Wire Co., Cleveland, Ohio.

Fig. 15. (Above). Cold-rolled stainless steel strip entering a continuous annealing furnace, Cuyahoga Works, American Steel & Wire Co., Cleveland.

Fig. 16. (Left). Continuous pickling of cold-rolled stainless strip after annealing, Cuyahoga Works.

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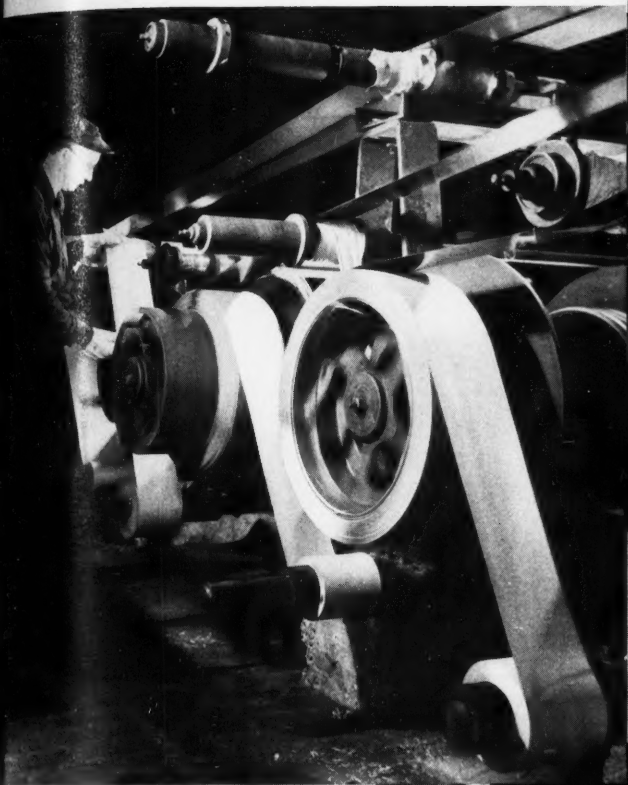
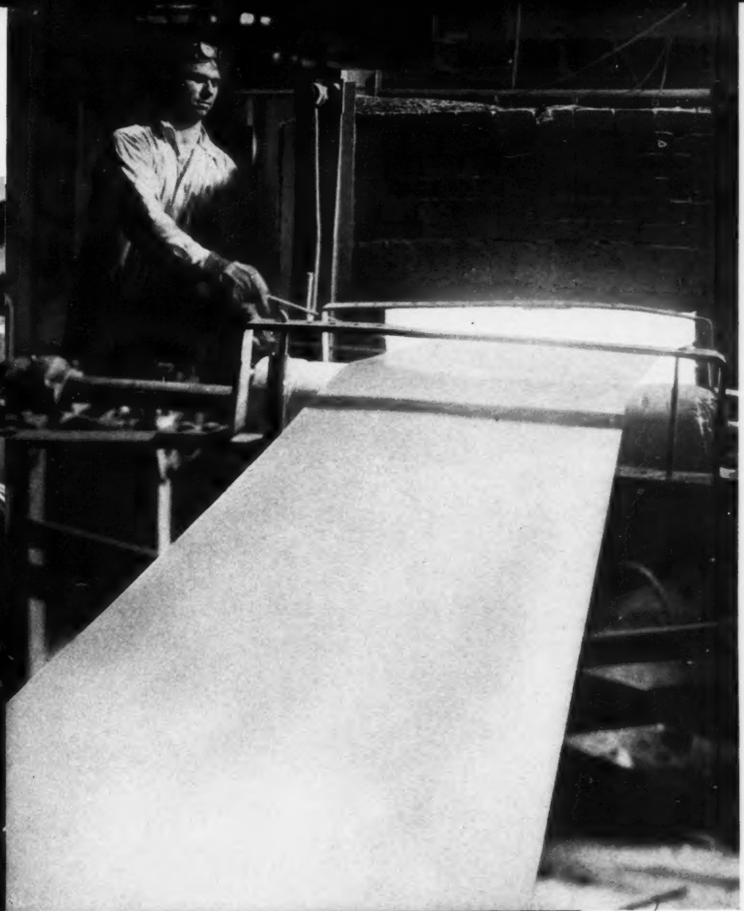




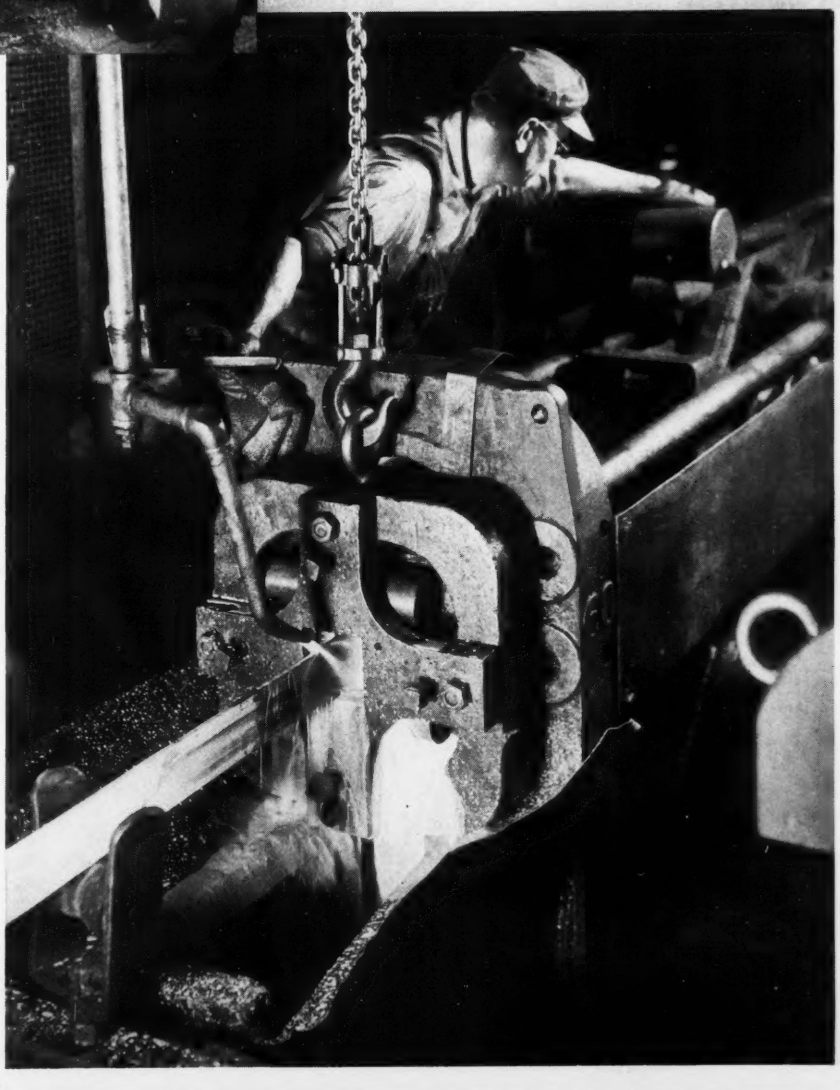


Fig. 17. (Above). Recoiling finished cold-rolled stainless steel strip preparatory to shipment, Cuyahoga Works. To protect the cold-rolled surface the strip is carefully interleaved with specially prepared paper. The paper, it will be noted, runs up from reels located near the floor.

Fig. 18. (Upper right). Extra-width cold-rolled stainless steel strip leaving continuous annealing furnace, Cuyahoga Works.

Fig. 19. (Right). Cold-drawing stainless steel flats, Newburgh Works, American Steel & Wire Co., Cleveland.

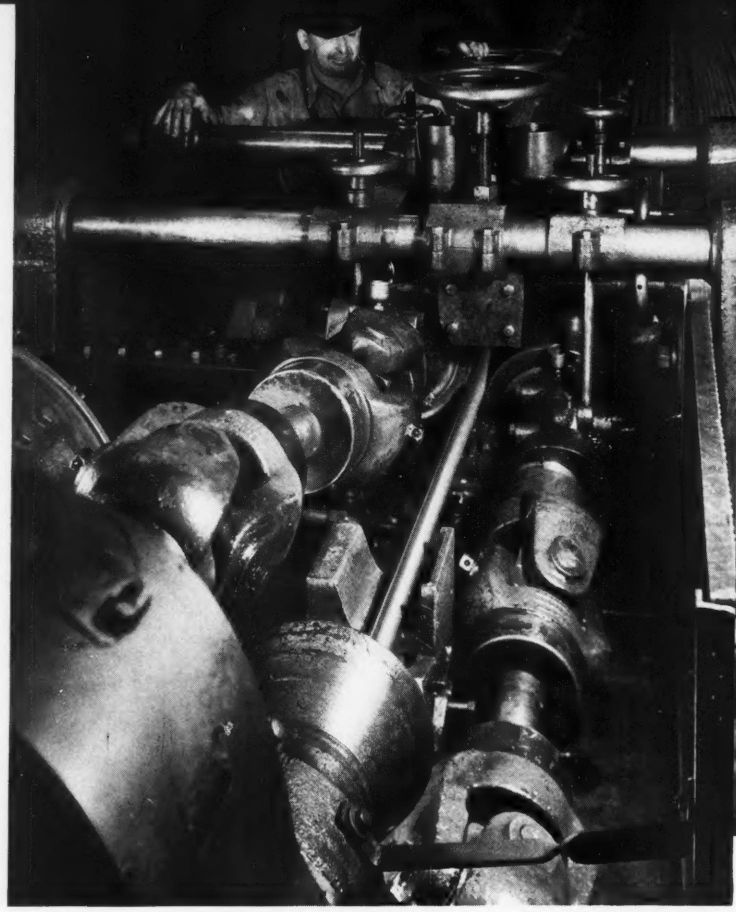
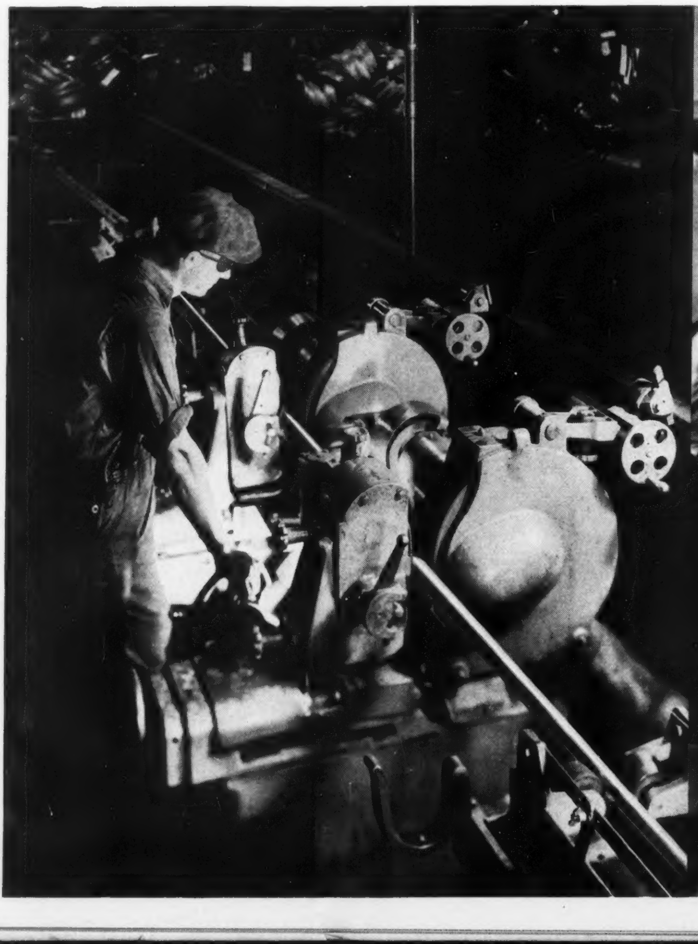


Fig. 20. (Above). Straightening and polishing stainless steel bars, Newburgh Works, American Steel & Wire Co.

Fig. 21. (Below). Polishing stainless steel bars in a centerless grinder. Newburgh Works.

Fig. 22 (Above). Drawing extremely fine stainless steel wire. American Works, American Steel & Wire Co., Cleveland.

Fig. 23. (Below). Annealing fine stainless steel wire, American Works.



Do You Know These Men?

KARL JOHN NELSON, '39 Chem. Eng.

Participation in athletics and a high record in scholarship combine to make "Whitey" Nelson an outstanding member of his class in Chemical Engineering. Throughout his four years at Cornell, he has held a prominent place on the football team while maintaining his studies at the high level necessary for membership in Tau Beta Pi.

Whitey's athletic history began in Technical High School of Springfield, Massachusetts, where he played football for four years, and was also a member of the golf and hockey teams. At Cornell he continued with football, playing four years and winning his "C" as a sophomore. Now that he is ineligible for competition Whitey has stayed with the team as an assistant coach for this spring and next year.

In addition to winning his "C", "Whitey" was on the Sophomore Smoker Committee, and was a member of Al-Djebar, honorary chemical society. As a Junior, he was elected to Aleph Samach, and served on the Junior Smoker Committee. During his senior year, Nelson was a member of Tau Beta Pi, Quill and Dagger, the Football Club, and the American Institute of Chemical Engineers. His fraternity, Sigma Nu, elected him treasurer and house manager for the last two years.

For recreation, "Whitey" has turned to reading, camping, and athletics. His summers have been profitably spent gaining practical experience in his chosen field. He has worked in the Technical Service Division of Standard Oil of Ohio and in the Research Department of the Merrimack Chemical Co. He also spent a summer as chief counselor at Camp of the Woods, Speculator, New York.

Nelson intends to be back here next year to complete the fifth year of his Chemical Engineering course.

WARREN LLOYD BOHNER, '38 A.E.-M.E.

The principal hobby of Warren Bohner is sailing, and in eight years at his favorite sport he has become an expert . Having sailed all types and sizes of boats, ranging from an eleven foot moth, up to a sixty-foot schooner. He also captained a forty foot yawl for eight weeks and has raced class 'A' catboats and Moths on Barnegat Bay. His experiences on the Atlantic include the New London to Gibson Island race and frequent trips along the Jersey shore. Warren is planning to enter the Bermuda race and make a trip to Norway under sail this summer.

Bohner attended Columbia High School of Maplewood, New Jersey, where his activities included three years on the Track team, the Business Managership of his school paper, and Treasurer of the Senior class. Upon coming to Cornell, Warren continued with Track and took up Cross Country running, in which he won his "C." These activities have won him membership in the Spiked Shoe and Cross Country Clubs.

That Warren has mastered his studies as well as athletics and sailing is amply proved by his membership in Tau Beta Pi, Phi Kappa Phi, and Kappa Tau Chi, of which he is Vice President. He has also shown his interest in Cornell by serving on the Freshman Advisory Committee, Junior Smoker Committee, Senior Class Drive, and as head of the M.E. division of the highly successful Engineering Show. His diversified activities have won him membership in Sphinx Head and Kappa Beta Phi.

Warren also has an interest in astronomy and at present is grinding the mirror for a six inch reflecting telescope.

In the line of practical experience, Warren has held jobs in the Distribution Division of the Carrier Corporation and with the Aluminum Company of America. Next fall he intends to start a two year training course with the sales division of Caterpillar Tractor Company, of Peoria. Nothing short of success can be predicted for a fine student with such widely diversified interests.

COLLEGE NOTES

The Faculty of the School of Civil Engineering
cordially invites all
Cornell Civil Engineers
and their families to the
Fifteenth Annual
Civil Engineers Breakfast
Alumni Day, Saturday, June 18, 1938
8:00-10:30 A. M.
Sibley Recreation Room

THE SHOW WAS A SUCCESS

The 1938 Cornell Day Engineering Show, this year inaugurating participation by the new Chemical Engineering School, proved more successful than any of its predecessors. This year in addition to greater attendance and general interest shown by the visitors and students participating, it was felt that the Show represented the entire College more completely. Starting three years ago upon the combination of the veteran Electrical Show with similar exhibits in the Mechanical and Civil schools, it has become a permanent part of the annual Cornell Day activities—an informal Open House for alumni of the engineering schools, subfreshman who wish to see a cross section of the students' undertakings, and Ithacans interested in seeing the latest in technical equipment and research at Cornell.

This year the Show was held both Friday and Saturday nights May 6 and 7 and special showing held for subfreshmen Saturday morning. Attendance was estimated at 2000 Friday night and 800 Saturday night with about 350 subfreshmen gathering in Sibley Dome on Saturday morning to be welcomed by Dean Hollister before splitting up into groups for direction through the show.

Plans for next year's exhibition include Saturday night again, for it is felt that numerous alumni have been unable to make the trip in time for Friday's show but will plan to come if it is held both nights.

As students were in charge of the technical and administrative duties under faculty supervision the show proved excellent experience for those connected with it. Much comment was heard on the greatly improved quality of the public address system, and the well planned Administrative Engineering booth in the Sibley show. These are but two examples of student effort which showed noteworthy results. There is always room for improvement in any exhibit so next year should provide opportunity for the committees to get to work on new ideas early.

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UNDERWOOD ATTENDS MEETING

Professor P. H. Underwood, acting director of the School of Civil Engineering, recently returned from Washington, D. C., where he attended the meeting of the American Geophysical Union, April 27-29. He presented a paper on "Advanced Surveying and Geodesy in the Curricula of Engineering Colleges Today" before the section on geodesy, of which he is vice-chairman.

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G. E. VISITS CAMPUS

Several representatives of the General Electric Company visited the College of Engineering, April 22, to present moving pictures, to exhibit various instruments recently developed by the company, and to interview seniors in the College of Engineering concerning employment.

A presentation of the subject of electrical measurement was given in the Franklin Hall Lecture Room by F. L. Duquette, meter and instrument specialists of the G.E. Company. The exhibit consisted of a four-reel talking motion picture, "When You Can Measure", which pointed out the importance of electrical measurement in modern life and which illustrated some highlights in the design and manufacture of G.E. instruments. Mr. Duquette also talked on modern industrial and laboratory instruments, and exhibited many of the newest instruments.

MYRON A. LEE

by John R. Bangs Jr.

The place to take the true measure of a man, is not in the busy world of everyday affairs, but by his own fireside. There he lays aside all pretense and we may learn to know him as he really is.

Rated by this standard, Myron Lee was one of nature's grandest noblemen. It was my privilege to spend my early instructor days at his "fireside;" there it was that I learned to know the finer, purer side of his nature. To him most aptly applies what W. C. Brann has written in A MAN'S REAL MEASURE: ". . . if his children rush to the front door to meet him and love's sunshine illumintes the face of his wife every time she hears his footfall, you can take it for granted that he is pure, for his home is a heaven . . ."

And now death has removed this fine man from our midst. Following an illness of five weeks, which involved a major operation for an abdominal obstruction, he passed peacefully to the arms of his maker. Cornell has lost one more of its pioneers; Ithaca one of its truly progressive civic leaders.

Myron Lee was born in Auburn, New York, on March 21, 1887, attended the public schools there, and later came to Cornell to study engineering. After graduating from Cornell in 1910, he joined the student apprentice course of the Western Electric Company at Hawthorne, Illinois. Shortly thereafter he was offered an instructorship at Cornell and he returned to teach and to do graduate work. He received the M.M.E. degree in 1913, became Assistant Professor in 1916, and full Professor and Head of the Department of Industrial Engineering in 1925. In this position he was intimately associated with Dean Emeritus Dexter S. Kimball.

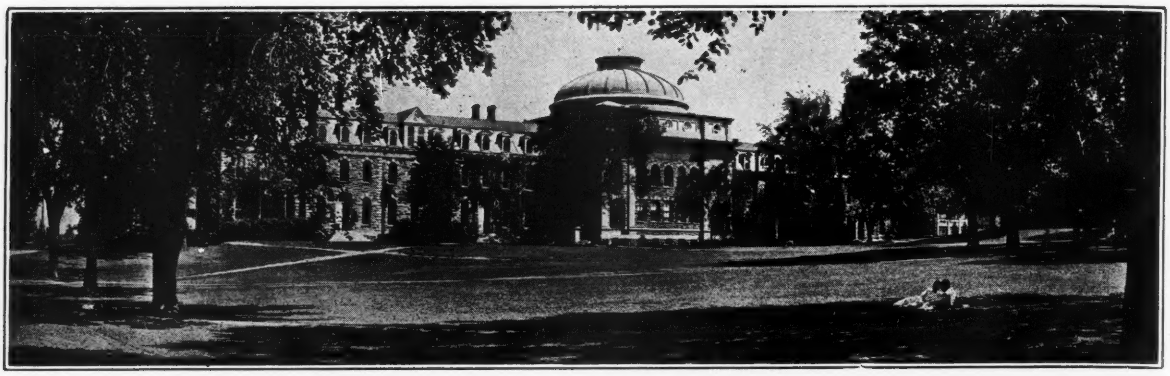
Always progressive, and possessing the vision of a real teacher, he planned, installed, and directed what was one of the first laboratory courses in Industrial Engineering in this country. Industry itself was quick to recognize his practical, discerning mind and he rapidly became an authority and a consultant in his chosen field. His writings include three books published by the International Correspondence School and widely used as textbooks: "Motion and Time Study," "Motion Economy," and "Wage Payments." He also contributed many articles to technical and business magazines.

Professor Lee was a pioneer in the field of industrial engineering. He was a member of the Society for the Promotion of Engineering Education, Sigma Xi, Tau Beta Pi, and Atmos. His practical experience, attained during leaves of absence from the University, included positions with the McIntosh, Seymour Company of Auburn, Western Electric Company, General Electric Company, Thomas-Morse Aircraft Corporation during the World War, and the Gleason Works at Rochester. He was in charge of the Work Simplification Course at the International Business Machines Corporation, Endicott, from August 1935 to February 1936. Active in fraternal and civic affairs in Ithaca, he was past master of Hobasco Lodge, F. and A.M., a director of the YMCA, and a member of St. John's Espicopal Church.

Professor Myron A. Lee
1887-1938

To the hundreds of students who have come under his guidance, he symbolizes Emerson's definition of a Friend, namely, "Some one who shall make us do what we can—when we are saying we can't." Always willing to give unstintingly of his time and effort, he combined with sound technical instruction a commonsense, practical philosophy to give the young engineer that extra something that only a real man and teacher can impart. Throughout the length and breadth of the country these men are carrying out his teachings. Affectionately the younger ones will recall him as "Prof." or "M. A."; reverently the old timers will remember his as "the chief" or "the boss."

Myron Lee's place can never be filled. Cornell and Ithaca will sorely miss his presence. We can only solace ourselves by knowing that his fine, upright personality and genial manner will live in our hearts and minds forever.



WHITE'S PAPER TO BE READ

Mr. Kendall G. White of our Department of Administrative Engineering will have his paper "Engineering Occupations After Graduation" read by John R. Bangs at College Station, Texas, June 30, 1938 at the meeting of the Committee on Professional Status and Employment of Engineering Graduates. This paper is based on a ten year survey of the graduates of the Sibley School of Mechanical Engineering.

Presiding over the meeting of this committee of the Society for the Promotion of Engineering Education will be Chairman Professor John R. Bangs, head of our Department of Administrative Engineering. He will also read former Dean Dexter S. Kimball's paper on "The Cultural Phase of Engineering Education" before the committee in the latter's absence.

Other Cornellians on this committee are R. M. Barnes '23-'24 M.S. Professor of Industrial Engineering, University of Iowa, C. C. Hedges '08 AB, '24 Ph.D., head of the Department of Chemistry and Chemical Engineering, Agricultural and Mechanical College of Texas, and J. E. Walters '34 Ph.D., Director of Personnel, Purdue University.

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CORNING GLASS TRIP

The School of Electrical Engineering offered an excellent opportunity to some 35 of its members when, on Friday, April 29th, they were taken on a thorough inspection trip of the Corning Glass Works. The trip, requiring about three hours, took the students through both the main plant and the Fall River Branch. Among the products seen were: glass tubing drawn to a length of two hundred feet before cutting; laboratory glassware, including flasks, beakers, retorts, etc.; Pyrex household ware, and expensive pieces of crystal table glass. As the majority of this (with the exception of the tubing) was hand blown by skilled glass blowers, the trip proved very entertaining as well as instructive. In addition, the students saw the oven in which the famed two hundred inch mirror was cooled at the rate of a fraction of a degree per day.

The last leg of the trip covered the fiber products division, where the new spun glass fabrics and Rock Wool insulation were under production. These spun glass fabrics, at present just out of the experimental stage, show great promise in the field of insulation.

Dinner was held at the Baron Steuben Hotel, in Corning, after which Mr. L. W. W. Morrow, General Manager of the Fiber Products Division, gave an interesting talk on the recent developments in glass research. The dinner was under the auspices of the A.I.E.E.

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TALK ON PLASTICS

C. A. Norris, '24, of the Bakelite Corporation spoke on "Plastics" before a combined meeting of the Student Branch of the American Institute of Electrical Engineers and the Sibley Engineering Society (formerly the Student Branch of the A.S.M.E.) on May 5. His instructive sound motion picture, "The Fourth Kingdom," and his plastics exhibit (which included prize winners in the recent show at Rockefeller Center) contributed to a highly interesting and non-technical program.

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NON RESIDENT LECTURE

C. D. Hart '06, superintendent of cable manufacturing at the Western Electric Plant at Point Breeze, Md., addressed students of the College of Engineering twice on Friday, April 22. At 9 A.M. he spoke to sophomores; and at 12 noon to seniors. His subject was "Mechanical and Electrical Developments in Telephone Cable Manufacturing."

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JOINT MEETING OF A.S.M.E. AND A.I.E.E.

The belief that the human ear can accurately measure sound has been the greatest obstacle in the way of developing methods of quieting machinery, according to Dr. E. J. Abbot, president of the Physicists Research Company of Ann Harbor, Mich, who addressed a joint meeting of the Ithaca and Cornell Student Chapters of the A.S.M.E. and A.I.E.E. in Baker Laboratory on April 22. Dr. Abbott, formerly a professor at the University of Michigan, is one of America's leading authorities on sound measurement as applied to the quieting of machinery.

CORNELL SOCIETY of ENGINEERS

CORNELL CLUB, NEW YORK, N. Y.

GUSTAV J. REQUARDT '09, PRESIDENT

WALKER L. CISLER '22, EXECUTIVE VICE PRESIDENT
DAVID HARMON '31, RECORDING SECRETARY

ELWYN E. SEELYE '04, SECRETARY-TREASURER
101 Park Avenue, New York, N. Y.

"The objects of this Society are to promote the Welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the college and the alumni."

President's Column

May 9, 1938

Fellow Engineers:

Do you have a third hand? How about your cold storage brain?

The young man starting out in the engineering profession should acquire the habit of filing away for future reference every useful scrap of information which comes his way. Memory cannot be depended upon; it must be backed up with a written record.

A compact personal notebook is of the first importance. In it should be placed tables of weights, mathematics, pipe dimensions, wire sizes, flow diagrams, interest and annunity tables, formulae, unit costs, construction standards, slab and beam tables and other fundamental data having to do with the engineer's particular work. The preparation of such a book in spare time, the keeping of it up to date and completely indexing it, will impress its information on one's mind and will save much time in thumbing through text books and the reference library when facts are wanted in a hurry. Such a book proves to be of high value when one is in the field or out of touch with the home office library. Such a book can in all truth be called the engineer's "third hand."

Sooner or later the engineer will begin collecting information not found in text books or ready referenced places. Such a collection will quickly become unwieldy and hard to manage unless the engineer devises a filing system suitable for his needs. Before he goes too far in his collecting, therefore, he should look up articles on the subject of filing in the engineering magazines, talk with his older engineering friends and perhaps consult an experienced librarian. Some men use the Dewey decimal system, others file by alphabet, location, type, or a system of numbers. The point should be stressed that a filing and indexing system must be devised and developed so that the material collected can be quickly found for use. Naturally, the system adopted must be simple so as to be easily understood and remembered. Many times it is necessary that an associate must make use of the collected data and thus a complicated filing system will prove vexatious.

The data and facts an engineer should collect are almost infinite. Modern theories of design, comparative costs, standards of various manufacturers of equipment, competitive materials, dimensions, capacities and costs of various types of plants, bridges, roads, machines or whatever it is the engineer is interested in, catalogues, reports, specifications, descriptive articles, fundamentals of other branches of engineering which are related to one's specialty, are some of the items which may be mentioned. The mass of things an engineer files away for future reference can be called a "cold storage brain."

Engineering magazines are prolific sources of information. The articles should not merely be read and the magazine filed away. Data from them should be abstracted, boiled down and put on standard size sheets suitable for filing. If one owns the magazine, the printed pages of the articles on one's specialty can be clipped out and filed. The abstract should include a breakdown where possible of costs per KW. or per million gallons or per cubic foot or per person, unit quantities, unit values, design standards and other fundamental units. When sufficent abstracts are made, the information they contain can be drawn together in a table for purposes of comparison. Such a table permits a comprehensive view of what other engineers are doing in one's own particular specialty.

The young engineer should busily collect copies of reports, plans and specifications of well known engineers made for cities, states or industries in his specialty when available. On many occasions notices of such reports are given in the magazines. When the young collector states a legitimate use for the report, the author in most cases, will grant his request for a copy. Many manufacturers print excellent catalogues

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of their products. These give tables of capacities, dimensions, weights and sometimes approximate unit costs of standard items of equipment which are most useful in the studies for preliminary design.

Material should not be collected into desk drawers or on open shelves. Section steel filing cabinets piled in stacks with drawers sliding on ball bearings, will be found most satisfactory. Filing in such manner will prevent material from being disturbed, getting lost or becoming dusty, offers easy transportability, and hides the miscellaneous and therefore unattractive character of the material from view.

Here are several "don'ts"; Collect only the material which is of value to one's specialty; otherwise, the files will become overburdened with material which must ultimately be thrown out. Don't file material which can easily be found elsewhere; abstract and boil down such material. Don't file material which is not authentic, contains wrong conclusions, has palpable errors or has no future life or use.

Collect or make notes at any and all times, but file the material at periodic intervals; set aside say a night or an afternoon a month for this. Give an index number or make a reference card for all data collected; it is most discouraging to "lose " an item. Be sure that you endorse all data to show its author, source and date of birth and acquirement. For all written stuff, use standard size sheets and if a typewriter is not available, ink, never a lead pencil.

One of the first attacks on a new engineering problem is to find out if others have tackled it and how they have solved it. That is what the "cold storage brain" is for. If these solutions have proved to be correct or economical, one can adopt them or can start from there to consider a new avenue of approach. The possession of past precedents in a file which quickly gives up its information, is a tool of tremendous value in increasing the reputation, knowledge and ability of any engineer.

Very truly yours,
G. J. Requardt, *President,*
Cornell Society of Engineers.

THOSE LITTLE THINGS

(*Continued from page* 209)

to accomplish this end, Coolidge had to go contrary to all precedent to find the process, and when he found it, infinite patience and attention to detail were required at each step.

Doing things the way everybody says they can't be done quite often brings useful results. Aluminum is light; lead is heavy. The two don't alloy in the molten state; so all the books stated that no useful alloy of the two could be made. The Aluminum Company of America didn't take this as gospel truth and tried it. They found that they could suspend 0.10% or so of Pb in Al, and when they did they got a vast improvement in machinability, something like that of leaded brass over lead-free brass. Free-machining leaded Al screw stock is now a commercial product of real economic value.

If one wished, he could go on with example after example drawn from the early days of Ford and the rest of the automobile industry, from radio, the aircraft industry, or any field where men of vision have dared to do things differently. It may be only some small detail, like the cast Ford crankshaft which violated all the old-time ideas of what a crankshaft should have in the way of strength and toughness, but which was a tardy recognition of the fact that for reasons other than strength requirements the crankshaft had become so big and so stiff that it didn't need to be made of the same old material, but a cheaper one would do just as well.

I don't care whether you call it discovery, invention, research, or just the application of horsè sense, but the chap who does something new or in a different way, who is alert enough to realize the moment his efforts trend toward something useful, and who then has the perseverance to follow through, stick with it, and get the effect of each "little thing" under control—he is the one who is going to give us what will be the necessities of tomorrow.

ALUMNI NOTES

Graduates of the engineering school find their way into many different industries. Many of them are engaged in pursuits other than purely engineering. Samuel S. Nuekols, EE, '28, is one of those who have not followed too closely their engineering training. Nuekols is flying for the American Airlines as 1st officer and reserve captain on the Ft. Worth-Los Angeles run. He is senior reserve pilot at the Glendale base. Nuekols has taken six months active duty with the Army Air Corps and since then he has been employed by the American Airlines.

Numerous Cornell engineers have gone into patent work. One of these is Francis P. Keiper who is employed by the Edward G. Budd Manufacturing Company. Francis received his law degree from George Washington University in 1934. Following this and before his association with the Budd Company, he was employed by the Bendix Aviation Corporation.

Alexander Rose, ME, '28, has done quite extensive traveling in connection with the Riley Stoker Corporation, Worcester, Mass., with whom he is associated. He is engineer in the service departmeint working out of Worcester. In his capacity of testing and installing steam generating units, he has been to Naples, the Persian Gulf, South America and elsewhere. He finds that engineering is a real profession in Italy. Apparently they consider it beneath them to get their hands dirty.

Austin Harris Church, ME, '28, is with the De Laval Steam Turbine Company in Trenton, New Jersey, working on special problems on turbines and airplane superchargers. Austin took graduate work and received his masters degree from New York University. Until 1936 he was an instructor in engineering subjects with the Cooper Union, New York City.

Raymond P. Morse, ME, '03, is president of the Safetex Company, manufacturers of Latex products, with offices at 160 Montague Street, Brooklyn, N. Y. He has been secretary of his class for many years and is now in charge of preparations for its thirty-five-year reunion next June.

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